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PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in Valves

We, GIRDLESTONE PUMPS LIMITED, of 23 Davies Street, London, W.1., a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to valves for fluids, more particularly those of the continuous operating type as used in pumps and the like, and has for its aim the provision of improved valve constructions of the type normally biassed towards a closed condition, in which the bias is achieved without mechanical means subject to wear, corrosion and breakage.

The invention consists in a valve construction comprising an annular valve seat which is either a magnet itself or has a magnet or magnets associated therewith and a spherical valve member of magnetic material which forms an armature for the seat magnet or magnets, means preferably being provided for constraining the valve member armature from being displaced beyond the effect range of attraction of the seat.

The invention further consists in a valve construction according to the preceding paragraph wherein the valve member or valve seat or both are coated at least over their co-operating surfaces with a non-magnetic material which is preferably resilient and, where necessary, non-corrosive, the thickness of the coating together being such as to reduce the magnetic attraction sufficiently to allow the valve to open under pressure. In addition to providing an air gap between the armature and the magnet for the reason explained, the coating or coatings also serve to protect the co-operating surfaces from metallic wear and to reduce battering shock.

The use of a spherical valve member co-operating with an annular valve seat, according to the present invention permits rotation of the valve member during work to afford continuous changes of face to the valve seat thereby avoiding localised fear on the valve member or its coating where such is provided.

The valve seat may itself comprise a generally annular shaped magnet presenting a north or south pole to the valve member (armature), for example, a so-called "pot" magnet, which is in effect an axially short bar magnet with a central aperture defining the inner periphery of the annulus. Alternatively a plurality of magnets may be arranged around a circle and be embedded or otherwise affixed to a non-magnetic structure forming the actual valve seat. As a still further alternative the valve seat may have a magnet or magnets disposed closely thereto without being incorporated in the valve seat structure, e.g. located in the bore or passageway of the valve.

Since this invention is not concerned with controllable valves, the magnet (or magnets) associated with or comprising the valve seat is most conveniently a permanent magnet, nevertheless the invention also contemplates the use of an electro-magnet permanently energised whenever the valve is operating.

In order to prevent the valve member from escaping from the limit of effective magnetic pull of the valve seat, it may be necessary to anchor or guide the valve member against excessive displacements; this could conveniently be accomplished, for example, by the provision of a cage or rails or by the use of stops.

The invention may be applied generally to valves of the type set out above, except where heat conditions during operation preclude the use of magnetised materials; the invention is particularly useful where robust, simple valve constructions are required as in, for example, pumps handling abrasive or corrosive liquids. It will be seen that, in a diaphragm pump, the magnetic attraction between the valve seat and the valve member takes the place of spring loading which is used merely to bias the valve member to close rapidly as each pressure drop takes place. In this it is assisted by the back

pull on the liquid as the diaphragm reverses and possibly also by gravity if the valve is operating with vertical or semi-vertical displacement, it will therefore be appreciated that the attractive force required in the magnetised seat is not very great.

In the accompanying drawings:—

Figure 1 is a sectional side elevation of a valve according to the present invention, and

Figure 2 is a cross-section on the line 2—2 of Figure 1.

In carrying the invention into effect according to one mode as applicable, by way of example, to the outlet of a diaphragm pump, the spherical valve member 1 is of magnetic material, such as iron, coated with a layer 2 of non-magnetic, resilient material such as polyethylene to a depth of, say, one-sixteenth of an inch. The valve seat 3 comprises an annular or pot magnet 4 disposed co-axially of the passage 5 which the valve is to control and located against a shoulder 6 in the passage wall to present either a north or south pole to the sphere 1, which thus forms the armature of the magnetic system. The magnet 4 is also shrouded in a layer 7 of non-magnetic resilient material such as polyethylene and the effect of these layers 2 and 7 is not only to reduce wear and damage as the valve operates and to prevent corrosion, but also imposes an "air-gap" between the armature sphere 1 and the magnet 4 to prevent magnetic "adhesion" between the parts so as to allow the valve to open smoothly under pressure.

In order to centralise the armature sphere 1, comprising the valve member, spaced guides or rails 8 are provided in the passage 5 downstream of the valve seat 3 and the displacement of the armature sphere 1 against the magnetic attraction of the magnet 4 may be further limited by providing a stop 9 so that the armature sphere 1 does not travel too far away from the magnet 4. The guides or rails 8 may conveniently be formed on a liner member 10 for the passage 5, which liner may be of non-corrosive material.

In operation, the valve member sphere 1 is magnetically biased to its valve closing position and will be displaced from the valve seat 3 on experiencing a pressure pulse from the upstream side of the valve. As soon as the pressure pulse dies, the magnetic attraction of the valve seat 3 will cause the member 1 to return and close the valve. The return of the member 1 may be assisted by a back-pull in the liquid on the change over to a suction stroke of the pump and also assistance may be obtained from gravity if the valve is disposed to operate with a vertical or semi-vertical displacement.

What we claim is:—

1. A valve construction comprising an anuular valve seat which is either a magnet itself or has a magnet or magnets associated therewith and a spherical valve member of magnetic material which forms an armature for the seat magnet or magnets.

2. A valve construction according to claim 1, wherein means are provided for constraining the valve member armature from being displaced beyond the effective range of attraction of the seat.

3. A valve construction according to claim 1 or 2, wherein the valve member or valve seat or both are coated at least over their co-operating surfaces with a non-magnetic material which is preferably resilient and, where necessary, non-corrosive.

4. A valve construction according to claim 1, 2 or 3, wherein the magnetic valve seat is in the form of a "pot" magnet.

5. A valve construction according to any of the preceding claims, wherein guides or rails are provided in the valve passageway to maintain the valve member centralised.

6. A valve construction substantially as described with reference to the accompanying drawings.

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PROVISIONAL SPECIFICATION

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The invention further consists in a valve construction according to the preceding paragraph wherein the valve member or valve seat or both are coated at least over their co-operating surfaces with a non-magnetic material which is preferably resilient and, where necessary, non-corrosive, the thickness of the coating together being such to reduce the magnetic attraction sufficiently to allow the valve to

open under pressure. In addition to providing an air gap between the armature and the magnet for the reason explained, the coating or coatings also serve to protect the co-operating surfaces from metallic wear and to reduce battering shock.

While the invention can be applied to valve seats and valve members of various shapes, a preferred embodiment is to use an annular seat and a spherical valve member, with which arrangement rotation of the valve member during work will afford continuous change of face to the valve seat thereby avoiding localised wear on the valve member or its coating where such is provided.

The valve seat may itself comprise a generally annular shaped magnet presenting a pair of poles to the valve member (armature); alternatively a plurality of magnets may be arranged around a circle and be embedded or otherwise affixed to a non-magnetic structure forming the actual valve seat. As a still further alternative the valve seat may have a magnet or magnets disposed closely thereto without being incorporated in the valve seat structure, e.g. located in the bore or passageway of the valve.

Since this invention is not concerned with controllable valves, the magnet (or magnets) associated with or comprising the valve seat is most conveniently a permanent magnet, nevertheless the invention also contemplates the use of an electro-magnet permanently energised whenever the valve is operating.

In order to prevent the valve member from escaping from the limit of effective magnetic pull of the valve seat, it may be necessary to anchor or guide the valve member against excessive displacement; this could conveniently be accomplished, for example, by the provision of a cage or rails in the case of a spherical valve, member or by the use of stops.

The invention may be applied generally to valves of the type set out above, except where heat conditions during operation preclude the use of magnetised materials; the invention is particularly useful where robust, simple valve constructions are required as in, for example, pumps handling abrasive or corrosive liquids. It will be seen that, in a diaphragm pump, the magnetic attraction between the valve seat and the valve member takes the place of spring loading which is used merely to bias the valve member to close rapidly as each pressure drop takes place. In this it is assisted by the back pull on the liquid as the diaphragm reverses and possibly also by gravity if the valve is operating with vertical or semi-vertical displacement, it will therefore be appreciated that the attractive force required in the magnetised seat is not very great.

In carrying the invention into effect according to one mode by way of example, the valve member is in the form of a hollow sphere of magnetic material, such as iron, coated with a layer of polythene to a depth of, say, one sixteenth of an inch. The valve seat comprises an annular magnet constructed by forming in a complete annulus of sufficient axial length two diametrically opposed gaps extending parallel to the axis and away from the end of the annulus forming the valve seating itself whereby the two arcuate (semi-circular) halves of the annulus (still connected at its other end) form north and south magnetic poles. The annular "horse-shoe" magnet, so formed, is then covered in polythene moulded to form a complete annulus embedding the magnet and presenting a continuous valve seat adjacent the north and south poles for co-operation with the valve member.

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744,858 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

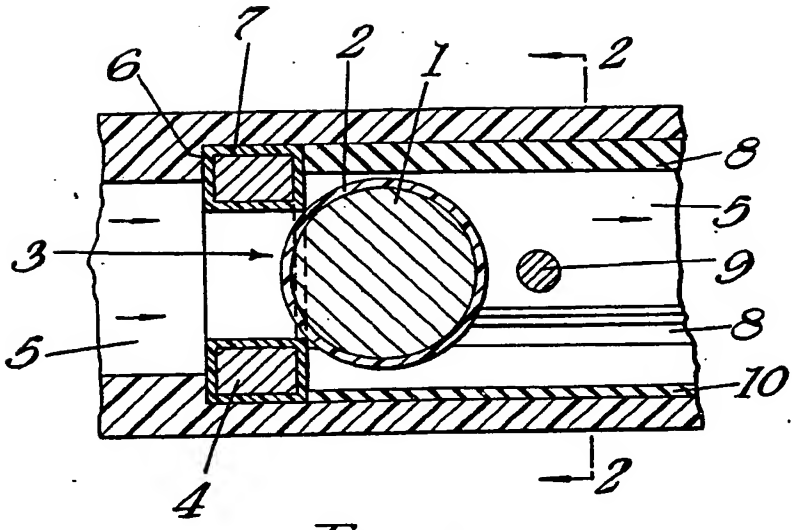

Fig. 1.

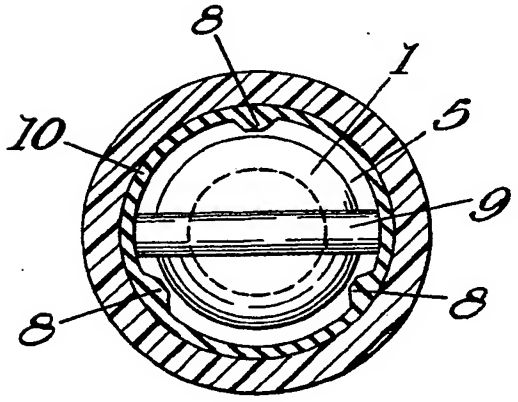

Fig. 2.